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PATENT ABSTRACTS OF JAPAN

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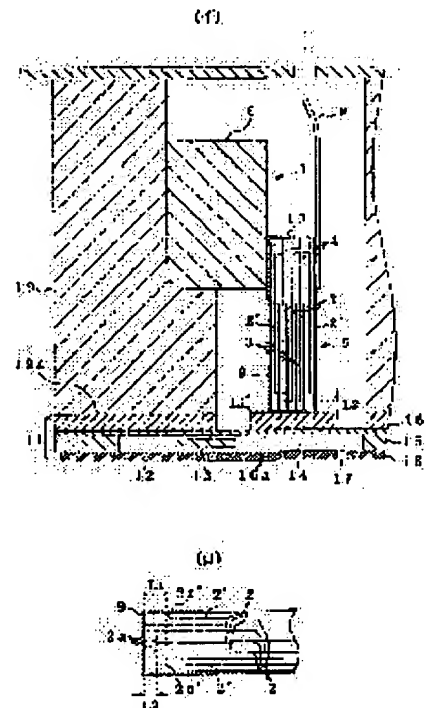
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(72)Inventor : KITAHARA TSUYOSHI

(54) INK-JET TYPE RECORDING HEAD, AND MANUFACTURE OF PIEZOELECTRIC VIBRATOR UNIT USED IN THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent a shortcircuit or an electric conduction of internal electrodes because of a brake of an edge part, etc.
SOLUTION: A distance L2 between a leading end 2a' of an internal electrode 2', 2' positioned at the outer side among internal electrodes 2, 2' buried in a piezoelectric material 4 spaced by a constant distance L2 from a leading end of a piezoelectric vibrator 5 at the side of a passage unit, and a leading end face of the piezoelectric vibrator 5 is set larger than a distance between a leading end of the other internal electrode 2, 2... of the same polarity and the leading end face of the piezoelectric vibrator. A long distance is secured between the internal electrode 2' at an edge part which is easy to brake and an external electrode 9 connected to an internal electrode 3 of the other polarity, thereby preventing an electric conduction.



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Patent Abstracts of Japan

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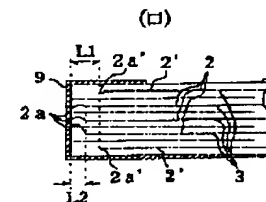
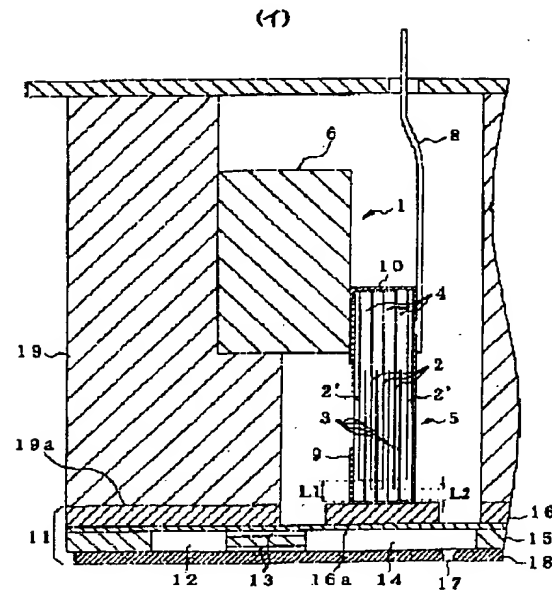
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INVENTOR : KITAHARA TSUYOSHI;

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H01L 41/083 H01L 41/24

TITLE : INK-JET TYPE RECORDING HEAD,
AND MANUFACTURE OF
PIEZOELECTRIC VIBRATOR UNIT
USED IN THE SAME



ABSTRACT : PROBLEM TO BE SOLVED: To prevent a shortcircuit or an electric conduction of internal electrodes because of a brake of an edge part, etc.

SOLUTION: A distance L2 between a leading end 2a' of an internal electrode 2', 2' positioned at the outer side among internal electrodes 2, 2' buried in a piezoelectric material 4 spaced by a constant distance L2 from a leading end of a piezoelectric vibrator 5 at the side of a passage unit, and a leading end face of the piezoelectric vibrator 5 is set larger than a distance between a leading end of the other internal electrode 2, 2... of the same polarity and the leading end face of the piezoelectric vibrator. A long distance is secured between the internal electrode 2' at an edge part which is easy to brake and an external electrode 9 connected to an internal electrode 3 of the other polarity, thereby preventing an electric conduction.

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CLAIMS

[Claim(s)]

[Claim 1] The piezoelectric transducer of the piezoelectric constant d_{31} which infixed and carried out the laminating of the piezoelectric material so that the 1st internal electrode of a pole and the 2nd internal electrode different in parallel with shaft orientations might be exposed only by each end face, respectively and a lap might be carried out in an oscillating field, In the becoming ink-jet formula record head the passage unit which has the elastic plate to which contact at the nose of cam of the aforementioned piezoelectric transducer, and expand and the capacity of a pressure occurrence room is made to reduce -- since -- The inside of the 1st internal electrode which keeps a fixed distance from the nose of cam by the side of the aforementioned passage unit of the aforementioned piezoelectric transducer, and is embedded at the aforementioned piezoelectric material, The ink-jet formula record head in which the distance of a nose of cam and the apical surface of the aforementioned piezoelectric transducer is formed more greatly than the distance of the nose of cam of other 1st internal electrode, and the aforementioned apical surface although located outside.

[Claim 2] the passage formation substrate in which the aforementioned passage unit divides and forms a reservoir, an ink feed hopper, and a pressure occurrence room, the elastic plate which it contacts at the nose of cam of the aforementioned piezoelectric transducer, and it expands [elastic plate] and shrinks the capacity of the aforementioned pressure occurrence room, and the nozzle plate equipped with nozzle opening which closes the field of another side of the aforementioned passage formation substrate, and is made to breathe out an ink drop -- liquid -- the ink-jet formula record head according to claim 1 constituted by carrying out a laminating densely

[Claim 3] The ink-jet formula record head according to claim 1 to which it is gradually set for a long time as the distance of the 1st internal electrode and the apical surface of the aforementioned piezoelectric transducer makes a central field the summit.

[Claim 4] The ink-jet formula record head according to claim 1 in which the layer of the aforementioned piezoelectric material of the outside of the 1st internal electrode located in the maximum outside is formed more thickly than the aforementioned internal inter-electrode one of other fields.

[Claim 5] The ink-jet formula record head [equipped with the external electrode which connects the 1st internal electrode of each aforementioned piezoelectric transducer in parallel by the end face of a non-vibrating field, and connects the 2nd internal electrode of each aforementioned piezoelectric transducer in parallel by the end face of an oscillating field] according to claim 1.

[Claim 6] The ink-jet formula record head according to claim 5 by which the external electrode which the external electrode linked to the 1st internal electrode connects to the 2nd [as a common electrode] internal electrode is connected to the flexible cable as a selection electrode.

[Claim 7] The ink-jet formula record head according to claim 5 by which the external electrode linked to the 1st internal electrode is connected to all the aforementioned piezoelectric transducer that constitutes a piezoelectric-transducer unit, and the parallel.

[Claim 8] The ink-jet formula record head according to claim 1 from which the non-vibrating field is fixed to a fixed substrate, and the aforementioned piezoelectric transducer is constituted by the piezoelectric-transducer unit.

[Claim 9] The ink-jet formula record head according to claim 5 by which the aforementioned piezoelectric transducer is being fixed to the aforementioned fixed substrate in the side face of the aforementioned non-vibrating field.

[Claim 10] The ink-jet formula record head according to claim 5 by which the aforementioned piezoelectric transducer is being fixed to the aforementioned fixed substrate in the end face of the aforementioned non-vibrating field.

[Claim 11] The ink-jet formula record head according to claim 1 constituted by the piezo-electric diaphragm of the piezoelectric constant d_{31} which infixed and carried out the laminating of the piezoelectric material so that the aforementioned piezoelectric transducer might expose the internal electrode of a pole different in parallel with shaft orientations by the end, respectively and might carry out a lap in an oscillating field by forming a slit.

[Claim 12] The ink-jet formula record head according to claim 11 by which the aforementioned slit is formed in the oscillating field.

[Claim 13] The ink-jet formula record head according to claim 12 toward which the end face of the aforementioned slit inclines to the array side of the aforementioned piezoelectric transducer.

[Claim 14] The end face of the aforementioned slit is a perpendicular ink-jet formula record head according to claim 12 to the array side of the aforementioned piezoelectric transducer.

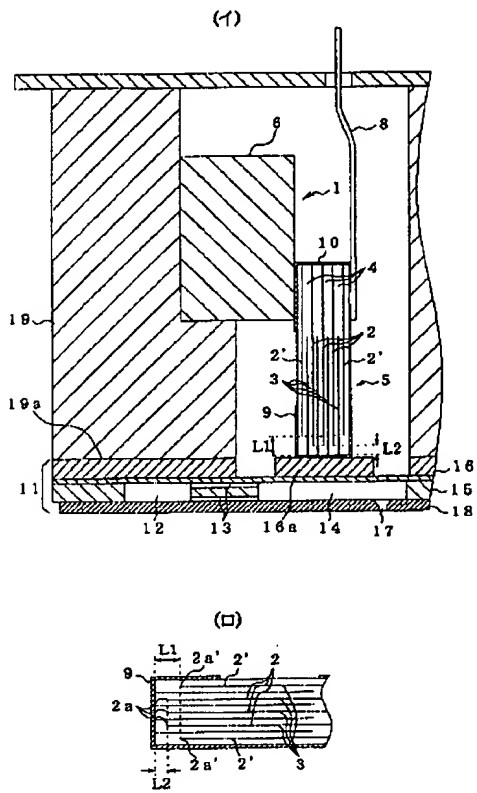
[Claim 15] The layer of a predetermined [double] size, the piezoelectric material of thickness, and the 1st electrical conducting material by which what is located outside leaves the agensis field where width of face is wide to one end face of the

aforementioned piezoelectric material, The process which forms in the other-end side of the aforementioned piezoelectric material by turns the layer of the 2nd electrical conducting material which leaves the agensis field of a constant width, The process calcinated in the phase which the laminating ended to predetermined thickness, and the process which forms the external electrode for connection in a front face, The manufacture technique of the piezoelectric-transducer unit for ink-jet formula record heads which consists of a process which forms and carries out the gear-tooth rate of the slit so that a non-vibrating field may be fixed to a fixed substrate and it may leave the continuity section to a non-vibrating field side.

[Claim 16] The manufacture technique of the piezoelectric-transducer unit for ink-jet formula record heads according to claim 15 that the aforementioned slit is formed so that it may leave the continuity section to a non-vibrating field.

[Translation done.]

Drawing selection [Representative drawing] ▼



[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The field of the technique in which invention belongs] this invention relates to the ink-jet formula record head which uses the piezoelectric transducer in the longitudinal-oscillation mode which piezoelectric material was made to intervene and carried out the laminating of two or more internal electrodes by turns for a pressure occurrence means.

[0002]

[Description of the Prior Art] The ink-jet record head which used the piezoelectric transducer in the longitudinal-oscillation mode Passage formation substrate D equipped with pressure occurrence room A, ink feed-hopper B, and reservoir C as shown in drawing 9 (b), Passage unit H which carried out the laminating of elastic-plate E which closes one field of passage formation substrate D, and the nozzle-plate G equipped with nozzle opening F which is open for free passage to pressure occurrence room A, It is the thing which it has two members with piezoelectric-transducer unit J, and it expands [thing], shrinks pressure occurrence room A by each piezoelectric-transducer K which constitutes piezoelectric-transducer unit J, and makes an ink drop breathe out from nozzle opening F. The laminating of the piezoelectric-transducer K is carried out so that the internal electrodes L and M of two poles may carry out a lap through piezoelectric-material N in an oscillating field, the external electrodes P and Q are fixed and it is constituted so that it may connect with each internal pole.

[0003] Such piezoelectric-transducer K creates two or more large-sized piezo-electric diaphragms of a part, in this, it is constituted by OFF division at the scutellum of a size of a vibrator unit, and each scutellum constitutes the external electrodes P and Q a fixture and by forming a slit in a fixed pitch so that the continuity section may remain the piezo-electric diaphragm of each scutellum in the end section by the wire saw etc. further.

[0004] However, in the phase which manufactures a large-sized piezo-electric diaphragm, by the laminating process and baking process of piezoelectric material, when a chip etc. arises in a corner and the external electrodes P and Q are formed by vacuum evaporation, sputtering, etc. in this status, as shown in drawing 9 (b), an electrical-conducting-material layer is formed also in deficit section R, the internal electrodes L and M flow between unlike poles, and there is a problem produce a malfunction.

[0005] From the first, although there is that no the piezoelectric-transducer unit of such a malfunction is incorporated by the close examination as a component part of a record head, there is a problem reduce the yield of a manufacture quickly so that the size of a piezoelectric transducer becomes small, in order to aim at enhancement in the recording density of a record head.

[0006] this invention is offering the ink-jet formula record head which can be made in view of such a problem, can make the minimum the malfunction of the piezoelectric transducer which **s against the deficit in the edge field of a piezoelectric transducer, and can aim at enhancement in the yield.

[0007] Moreover, other purposes of this invention are proposing the manufacture technique of the piezoelectric-transducer unit used for an ink-jet formula record head same as the above.

[0008]

[Means for Solving the Problem] In order to solve such a problem, it sets to this invention. The piezoelectric transducer of the piezoelectric constant d31 which infixed and carried out the laminating of the piezoelectric material so that the 1st internal electrode of a pole and the 2nd internal electrode different in parallel with shaft orientations might be exposed only by each end face, respectively and a lap might be carried out in an oscillating field, In the becoming ink-jet formula record head the passage unit which has the elastic plate to which contact at the nose of cam of the aforementioned piezoelectric transducer, and expand and the capacity of a pressure occurrence room is made to reduce -- since -- The inside of the 1st internal electrode which keeps a fixed distance from the nose of cam by the side of the aforementioned passage unit of the aforementioned piezoelectric transducer, and is embedded at the aforementioned piezoelectric material, Although located outside, the distance of a nose of cam and the apical surface of the aforementioned piezoelectric transducer was made to form more greatly than the distance of the nose of cam of other 1st internal electrode, and the aforementioned apical surface.

[0009]

[Function] Since the distance of the 1st internal electrode in the edge section which a chip tends to produce, and the external electrode linked to the 2nd internal electrode is long, even if the electric conduction layer for external electrodes is formed in the deficit section, the contact to the 1st internal electrode which is other poles is prevented.

[0010]

[The mode of implementation of invention] Then, based on the example illustrating the detail of this invention, it explains below.

In the piezoelectric transducer 5 which infixed and carried out the laminating of the piezoelectric material 4 so that the internal electrodes 2 and 3 of a pole different in parallel with shaft orientations might be exposed by the end, respectively and a lap might be carried out in an oscillating field, it arranges to the fixed substrate 6 and the piezoelectric-transducer unit 1 by which drawing 1 shows one example of this invention, and this invention is characterized is constituted from constant pitch, as shown in drawing 2. In addition, the signs in drawing 7 and 7 show the piezoelectric transducer of the dummy for a piezoelectric-transducer unit positioning prepared in the edge of the successive installation orientation of a piezoelectric transducer.

[0011] If it applies to the front-face side of the fixed substrate 6 from the exposed surface of the internal electrodes 2 and 3 of the nose of cam of each piezoelectric transducer 5, and the back end, the external electrodes 9 and 10 which form the connection with the flexible cable 8 which supplies a driving signal are formed of vacuum evaporation or sputtering.

[0012] a piezoelectric transducer -- five -- the back end -- a side -- exposing -- a nose of cam -- a side -- **** -- an edge -- two -- a -- piezoelectric material -- four -- laying underground -- having -- the interior -- an electrode -- two -- ' -- two -- two -- -- inside -- an outside -- being located -- a thing -- two -- ' -- an apical surface -- **** -- distance -- L -- one -- others -- the interior -- an electrode -- two -- two -- .. -- an apical surface -- distance -- L --

[0013] the nozzle plate 18 equipped with the nozzle opening 17 which the passage formation unit 11 closes the field of another side of the passage formation substrate 15 which divides and forms a reservoir 12, the ink feed hopper 13, and the pressure occurrence room 14, the elastic plate 16 to which contact at the nose of cam of a piezoelectric transducer 5, and expand and the capacity of the pressure occurrence room 14 is made to reduce, and the passage formation substrate 15, and makes the ink of the pressure occurrence room 14 breathe out as an ink drop --

[0014] By fixing the passage formation unit 11 to effective-area 19a of the head electrode holder 19, the piezoelectric-transducer unit 1 applies adhesives at the nose of cam of a piezoelectric transducer 5, and is made to contact island section 16a of an elastic plate 16, the fixed substrate 6 and the head electrode holder 19 are fixed with adhesives, and the ink-jet formula record head is constituted.

[0015] In this example, if a driving signal is impressed to the piezoelectric transducer 5 which counters the pressure occurrence room 14 which is open for free passage to the nozzle opening 17 which should make an ink drop breathe out, it contracts and expands, and a piezoelectric transducer 5 will expand and will shrink the pressure occurrence room 14. The ink of a reservoir 12 flows into the pressure occurrence room 14 through the ink feed hopper 13 by this, subsequently the ink of the pressure occurrence room 14 is pressurized, and the regurgitation is carried out as an ink drop from the nozzle opening 17.

[0016] By the way, a chip etc. may arise among the edge section in the process in which a large-sized piezo-electric diaphragm is manufactured. Although electric conduction layer 9' will be formed also in deficit section R as shown in drawing 3 when the external electrode 9 is fixed by vacuum evaporation, sputtering, etc. of an electrical conducting material in the status that this chip exists internal electrode 2' located outside among the internal electrode 2 and 2** The internal electrode of the pole which is not formed if electric conduction layer 9' straddles the internal electrode 2 and the internal electrode 3 of other poles in some chip, therefore is different does not become rather than deficit section R, since it is located in the back end, causes situations, such as a flow, from the internal electrode located inside.

[0017] In addition, although an above-mentioned example sets and it is made to retreat only internal electrode 2' of the maximum outside, and 2' The internal electrode 2 located in a core among the internal electrodes which are not exposed at a nose of cam as shown in drawing 4 (b) is made into the longest. Internal electrode 2" which separates from a core, and an internal inter-electrode flow of the unlike pole by the electric conduction layer formed in the deficit section if it forms so that 2' may become short can be more prevented to an authenticity.

[0018] Moreover, if thickness G of the piezoelectric material 4 of internal electrode 2' which is not exposed at a nose of cam as shown in drawing 4 (b), and is located in the maximum outside, and the external electrode 9 is made thicker than the thickness of the piezoelectric material 4 into which it is inserted by other internal electrodes, an internal inter-electrode flow of the unlike pole by the electric conduction layer formed in the deficit section like drawing 4 (b) can be more prevented to an authenticity.

[0019] The drawing 5 or the drawing 7 lays the green sheet 21 of the piezoelectric material which shows one example to the manufacture technique of such a piezoelectric transducer 5, and has a size for two or more sheets in the surface plate 20 with a flat front face, and was beforehand fabricated by class thickness (drawing 5 (I)).

[0020] The layer 22 of an electrical conducting material is formed using the mask equipped with the pattern which makes only L1 an agensis field from nose of cam 21a of the pattern located in the maximum outside among one internal electrodes 3 on the surface of this, i.e., a glee sheet, (drawing 5 (II)), and the green sheet 21 of the piezoelectric material of the above-mentioned and the same size is piled up (drawing 5 (III)).

[0021] The mask equipped with the pattern which forms the internal electrode 3 used as the pole of another side is used, the layer 23 of an electrical conducting material is formed so that width of face L3 which is equivalent to an oscillating field from edge 21a of a green sheet may be made into a formation field (drawing 6 (I)), and the green sheet 21 of the piezoelectric material of the above-mentioned and the same size is piled up (drawing 6 (II)).

[0022] Only L2 forms layer 22' of an electrical conducting material from nose of cam 21a of a glee sheet using the mask equipped with the pattern made into an agensis field (drawing 6 (III)). Such a process is repeated, and in forming another [which serves as the maximum outside among the internal electrodes used as one pole] internal electrode 2', the layer 22 of an electrical conducting material is formed from nose of cam 21a of a glee sheet like the process of drawing 5 (II) using the mask equipped with the pattern which makes only L1 an agensis field, and it piles up the green sheet 21 of piezoelectric material. In the phase which the laminating ended to predetermined thickness, since a green sheet is dried, it calcinates.

[0023] Thereby, since the piezo-electric diaphragm for two or more sheets is completed, after forming the external electrodes 33 and 36 used as the electrode for the connection with a flexible cable in a front face by sputtering or vacuum evaporation, impressing a voltage to these electrodes 33 and 36 and performing predetermined polarization processing, it kicks by OFF to the scutellum of the size equivalent to a piezoelectric-transducer unit.

[0024] The electric conduction layer 23 which flowed [positioned the piezoelectric-material plate 30 kicked by the scutellum by OFF to the fixed substrate 31, and fixed / with drawing 7 (I) adhesives / (drawing 7 (II))] by the external electrode 33 by the nose of cam side at least, A piezoelectric transducer 5 is completed by forming a slit 35 by the disconnection meanses 34, such as a wire saw, and carrying out a gear-tooth rate from a nose of cam, to the position of the grade which can separate this external electrode layer 33 both. In addition, it forms, and the slit 35 is formed so that it may become slanting to the array side of a piezoelectric transducer and it may become perpendicular, as the termination illustrated.

[0025] Thus, by forming a slit 35 in the status that the external electrode layer 33 by the side of a nose of cam can be separated, and the external electrode 36 by the side of the back end can be made to continue, the external electrode 33 can be formed in a selection electrode, and electric resistance can use the external electrode 36 as a small common electrode as much as possible.

[0026] In addition, in the above-mentioned example, although it was made to fix to the fixed substrate, as the inactive field of a piezoelectric transducer was shown in drawing 8 , even if it fixes the end face by the side of a non-vibrating field to the front face of the fixed substrate 37, it is clear to do the same operation so.

[0027]

[Effect of the Invention] The inside of the 1st internal electrode which keeps a fixed distance from the nose of cam by the side of the passage unit of a piezoelectric transducer, and is embedded in this invention at piezoelectric material as explained above, Although located outside, since the distance of a nose of cam and the apical surface of a piezoelectric transducer formed more greatly than that of other 1st internal electrode A long distance can be secured between the 1st internal electrode in the edge section which a chip tends to produce, and the external electrode linked to the 2nd internal electrode, and a contact in the electric conduction layer for the external electrodes of the deficit section can be prevented.

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TECHNICAL FIELD

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[The field of the technique in which invention belongs] this invention relates to the ink-jet formula record head which uses the piezoelectric transducer in the longitudinal-oscillation mode which piezoelectric material was made to intervene and carried out the laminating of two or more internal electrodes by turns for a pressure occurrence means.

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PRIOR ART

[Description of the Prior Art] The ink-jet record head which used the piezoelectric transducer in the longitudinal-oscillation mode Passage formation substrate D equipped with pressure occurrence room A, ink feed-hopper B, and reservoir C as shown in drawing 9 (b), Passage unit H which carried out the laminating of elastic-plate E which closes one field of passage formation substrate D, and the nozzle-plate G equipped with nozzle opening F which is open for free passage to pressure occurrence room A, It is the thing which it has two members with piezoelectric-transducer unit J, and it expands [thing], shrinks pressure occurrence room A by each piezoelectric-transducer K which constitutes piezoelectric-transducer unit J, and makes an ink drop breathe out from nozzle opening F. The laminating of the piezoelectric-transducer K is carried out so that the internal electrodes L and M of two poles may carry out a lap through piezoelectric-material N in an oscillating field, the external electrodes P and Q are fixed and it is constituted so that it may connect with each internal pole.

[0003] Such piezoelectric-transducer K creates two or more large-sized piezo-electric diaphragms of a part, in this, it is constituted by OFF division at the scutellum of a size of a vibrator unit, and each scutellum constitutes the external electrodes P and Q a fixture and by forming a slit in a fixed pitch so that the continuity section may remain the piezo-electric diaphragm of each scutellum in the end section by the wire saw etc. further.

[0004] However, in the phase which manufactures a large-sized piezo-electric diaphragm, by the laminating process and baking process of piezoelectric material, when a chip etc. arises in a corner and the external electrodes P and Q are formed by vacuum evaporation, sputtering, etc. in this status, as shown in drawing 9 (b), an electrical-conducting-material layer is formed also in deficit section R, the internal electrodes L and M flow between unlike poles, and there is a problem produce a malfunction.

[0005] From the first, although there is that no the piezoelectric-transducer unit of such a malfunction is incorporated by the close examination as a component part of a record head, there is a problem reduce the yield of a manufacture quickly so that the size of a piezoelectric transducer becomes small, in order to aim at enhancement in the recording density of a record head.

[0006] this invention is offering the ink-jet formula record head which can be made in view of such a problem, can make the minimum the malfunction of the piezoelectric transducer which **s against the deficit in the edge field of a piezoelectric transducer, and can aim at enhancement in the yield.

[0007] Moreover, other purposes of this invention are proposing the manufacture technique of the piezoelectric-transducer unit used for an ink-jet formula record head same as the above.

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EFFECT OF THE INVENTION

[Effect of the Invention] The inside of the 1st internal electrode which keeps a fixed distance from the nose of cam by the side of the passage unit of a piezoelectric transducer, and is embedded in this invention at piezoelectric material as explained above, Although located outside, since the distance of a nose of cam and the apical surface of a piezoelectric transducer formed more greatly than that of other 1st internal electrode A long distance can be secured between the 1st internal electrode in the edge section which a chip tends to produce, and the external electrode linked to the 2nd internal electrode, and a contact in the electric conduction layer for the external electrodes of the deficit section can be prevented.

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MEANS

[Means for Solving the Problem] In order to solve such a problem, it sets to this invention. The piezoelectric transducer of the piezoelectric constant d31 which infixed and carried out the laminating of the piezoelectric material so that the 1st internal electrode of a pole and the 2nd internal electrode different in parallel with shaft orientations might be exposed only by each end face, respectively and a lap might be carried out in an oscillating field, In the becoming ink-jet formula record head the passage unit which has the elastic plate to which contact at the nose of cam of the aforementioned piezoelectric transducer, and expand and the capacity of a pressure occurrence room is made to reduce -- since -- The inside of the 1st internal electrode which keeps a fixed distance from the nose of cam by the side of the aforementioned passage unit of the aforementioned piezoelectric transducer, and is embedded at the aforementioned piezoelectric material, Although located outside, the distance of a nose of cam and the apical surface of the aforementioned piezoelectric transducer was made to form more greatly than the distance of the nose of cam of other 1st internal electrode, and the aforementioned apical surface.

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MEANS

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OPERATION

[Function] Since the distance of the 1st internal electrode in the edge section which a chip tends to produce, and the external electrode linked to the 2nd internal electrode is long, even if the electric conduction layer for external electrodes is formed in the deficit section, the contact to the 1st internal electrode which is other poles is prevented.

[0010]

[The mode of implementation of invention] Then, based on the example illustrating the detail of this invention, it explains below. In the piezoelectric transducer 5 which infixed and carried out the laminating of the piezoelectric material 4 so that the internal electrodes 2 and 3 of a pole different in parallel with shaft orientations might be exposed by the end, respectively and a lap might be carried out in an oscillating field, it arranges to the fixed substrate 6 and the piezoelectric-transducer unit 1 by which drawing 1 shows one example of this invention, and this invention is characterized is constituted from constant pitch, as shown in drawing 2. In addition, the signs in drawing 7 and 7 show the piezoelectric transducer of the dummy for a piezoelectric-transducer unit positioning prepared in the edge of the successive installation orientation of a piezoelectric transducer.

[0011] If it applies to the front-face side of the fixed substrate 6 from the exposed surface of the internal electrodes 2 and 3 of the nose of cam of each piezoelectric transducer 5, and the back end, the external electrodes 9 and 10 which form the connection with the flexible cable 8 which supplies a driving signal are formed of vacuum evaporation or sputtering.

[0012] a piezoelectric transducer -- five -- the back end -- a side -- exposing -- a nose of cam -- a side -- **** -- an edge -- two -- a -- piezoelectric material -- four -- laying underground -- having -- the interior -- an electrode -- two -- ' -- two -- two -- -- inside -- an outside -- being located -- a thing -- two -- ' -- an apical surface -- **** -- distance -- L -- one -- others -- the interior -- an electrode -- two -- two -- .. -- an apical surface -- distance -- L --

[0013] the nozzle plate 18 equipped with the nozzle opening 17 which the passage formation unit 11 closes the field of another side of the passage formation substrate 15 which divides and forms a reservoir 12, the ink feed hopper 13, and the pressure occurrence room 14, the elastic plate 16 to which contact at the nose of cam of a piezoelectric transducer 5, and expand and the capacity of the pressure occurrence room 14 is made to reduce, and the passage formation substrate 15, and makes the ink of the pressure occurrence room 14 breathe out as an ink drop --

[0014] By fixing the passage formation unit 11 to effective-area 19a of the head electrode holder 19, the piezoelectric-transducer unit 1 applies adhesives at the nose of cam of a piezoelectric transducer 5, and is made to contact island section 16a of an elastic plate 16, the fixed substrate 6 and the head electrode holder 19 are fixed with adhesives, and the ink-jet formula record head is constituted.

[0015] In this example, if a driving signal is impressed to the piezoelectric transducer 5 which counters the pressure occurrence room 14 which is open for free passage to the nozzle opening 17 which should make an ink drop breathe out, it contracts and expands, and a piezoelectric transducer 5 will expand and will shrink the pressure occurrence room 14. The ink of a reservoir 12 flows into the pressure occurrence room 14 through the ink feed hopper 13 by this, subsequently the ink of the pressure occurrence room 14 is pressurized, and the regurgitation is carried out as an ink drop from the nozzle opening 17.

[0016] By the way, a chip etc. may arise among the edge section in the process in which a large-sized piezo-electric diaphragm is manufactured. Although electric conduction layer 9' will be formed also in deficit section R as shown in drawing 3 when the external electrode 9 is fixed by vacuum evaporation, sputtering, etc. of an electrical conducting material in the status that this chip exists Internal electrode 2' located outside among the internal electrode 2 and 2** The internal electrode of the pole which is not formed if electric conduction layer 9' straddles the internal electrode 2 and the internal electrode 3 of other poles in some chip, therefore is different does not become rather than deficit section R, since it is located in the back end, causes situations, such as a flow, from the internal electrode located inside.

[0017] In addition, although an above-mentioned example sets and it is made to retreat only internal electrode 2' of the maximum outside, and 2' The internal electrode 2 located in a core among the internal electrodes which are not exposed at a nose of cam as shown in drawing 4 (b) is made into the longest. Internal electrode 2" which separates from a core, and an internal inter-electrode flow of the unlike pole by the electric conduction layer formed in the deficit section if it forms so that 2' may become short can be more prevented to an authenticity.

[0018] Moreover, if thickness G of the piezoelectric material 4 of internal electrode 2' which is not exposed at a nose of cam as shown in drawing 4 (b), and is located in the maximum outside, and the external electrode 9 is made thicker than the thickness of the piezoelectric material 4 into which it is inserted by other internal electrodes, an internal inter-electrode flow of the unlike pole by the electric conduction layer formed in the deficit section like drawing 4 (b) can be more prevented to an authenticity.

[0019] The drawing 5 or the drawing 7 lays the green sheet 21 of the piezoelectric material which shows one example to the manufacture technique of such a piezoelectric transducer 5, and has a size for two or more sheets in the surface plate 20 with a flat front face, and was beforehand fabricated by class thickness (drawing 5 (I)).

[0020] The layer 22 of an electrical conducting material is formed using the mask equipped with the pattern which makes only L1 an agenesis field from nose of cam 21a of the pattern located in the maximum outside among one internal electrodes 3 on the surface of this, i.e., a glee sheet, (drawing 5 (II)), and the green sheet 21 of the piezoelectric material of the above-mentioned and the same size is piled up (drawing 5 (III)).

[0021] The mask equipped with the pattern which forms the internal electrode 3 used as the pole of another side is used, the layer 23 of an electrical conducting material is formed so that width of face L3 which is equivalent to an oscillating field from edge 21a of a green sheet may be made into a formation field (drawing 6 (I)), and the green sheet 21 of the piezoelectric material of the above-mentioned and the same size is piled up (drawing 6 (II)).

[0022] Only L2 forms layer 22' of an electrical conducting material from nose of cam 21a of a glee sheet using the mask equipped with the pattern made into an agenesis field (drawing 6 (III)). Such a process is repeated, and in forming another [which serves as the maximum outside among the internal electrodes used as one pole] internal electrode 2', the layer 22 of an electrical conducting material is formed from nose of cam 21a of a glee sheet like the process of drawing 5 (II) using the mask equipped with the pattern which makes only L1 an agenesis field, and it piles up the green sheet 21 of piezoelectric material. In the phase which the laminating ended to predetermined thickness, since a green sheet is dried, it calcinates.

[0023] Thereby, since the piezo-electric diaphragm for two or more sheets is completed, after forming the external electrodes 33 and 36 used as the electrode for the connection with a flexible cable in a front face by sputtering or vacuum evaporation, impressing a voltage to these electrodes 33 and 36 and performing predetermined polarization processing, it kicks by OFF to the scutellum of the size equivalent to a piezoelectric-transducer unit.

[0024] The electric conduction layer 23 which flowed [positioned the piezoelectric-material plate 30 kicked by the scutellum by OFF to the fixed substrate 31, and fixed / with drawing 7 (I) adhesives / (drawing 7 (II))] by the external electrode 33 by the nose of cam side at least, A piezoelectric transducer 5 is completed by forming a slit 35 by the disconnection meanses 34, such as a wire saw, and carrying out a gear-tooth rate from a nose of cam, to the position of the grade which can separate this external electrode layer 33 both. In addition, it forms, and the slit 35 is formed so that it may become slanting to the array side of a piezoelectric transducer and it may become perpendicular, as the termination illustrated.

[0025] Thus, by forming a slit 35 in the status that the external electrode layer 33 by the side of a nose of cam can be separated, and the external electrode 36 by the side of the back end can be made to continue, the external electrode 33 can be formed in a selection electrode, and electric resistance can use the external electrode 36 as a small common electrode as much as possible.

[0026] In addition, in the above-mentioned example, although it was made to fix to the fixed substrate, as the inactive field of a piezoelectric transducer was shown in drawing 8, even if it fixes the end face by the side of a non-vibrating field to the front face of the fixed substrate 37, it is clear to do the same operation so.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing (b) and (b) are the cross section showing one example of the ink-jet formula record head of this invention, and drawing expanding and showing the nose of cam of a piezoelectric transducer.

[Drawing 2] It is the perspective diagram showing one example of the piezoelectric-transducer unit used for a record head same as the above.

[Drawing 3] It is drawing expanding and showing the nose of cam of the piezoelectric transducer of a piezoelectric-transducer unit same as the above.

[Drawing 4] Drawing (b) and (b) are drawings showing other examples of the ink-jet formula record head of this invention with the gestalt of a piezoelectric transducer, respectively.

[Drawing 5] It is drawing showing the process in the first half of the manufacture technique of a piezo-electric diaphragm among the manufacture technique of drawing (I) or (III) a piezoelectric-transducer unit same as the above.

[Drawing 6] It is drawing showing the process in the second half of the manufacture technique of a piezo-electric diaphragm among the manufacture technique of drawing (I) or (III) a piezoelectric-transducer unit same as the above.

[Drawing 7] It is drawing showing the process which forms a piezoelectric transducer using a piezo-electric diaphragm among the manufacture technique of drawing (I) or (III) a piezoelectric-transducer unit same as the above.

[Drawing 8] It is the perspective diagram showing other examples of this invention.

[Drawing 9] Drawing (b) and (b) are drawings expanding and showing the conventional ink-jet formula record head and the nose of cam of the piezoelectric transducer of this, respectively.

[Description of Notations]

- 1 Piezoelectric-Transducer Unit
- 2, 2' Internal electrode of one pole
- 3 Internal Electrode of Pole of Another Side
- 4 Piezoelectric Material
- 5 Piezoelectric Transducer
- 6 Fixed Substrate
- 11 Passage Formation Unit
- 12 Reservoir
- 13 Ink Feed Hopper
- 14 Pressure Occurrence Room
- 17 Nozzle Opening
- R Deficit section

[Translation done.]

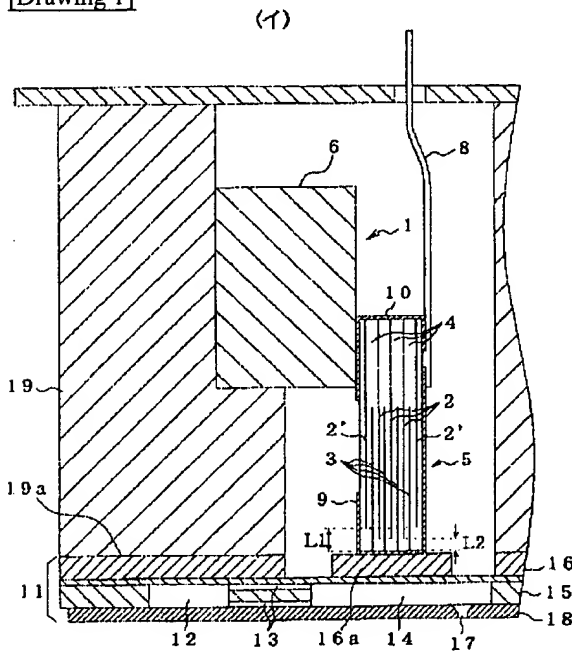
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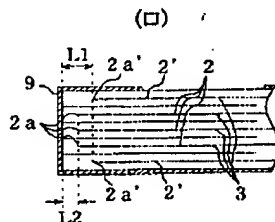
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DRAWINGS

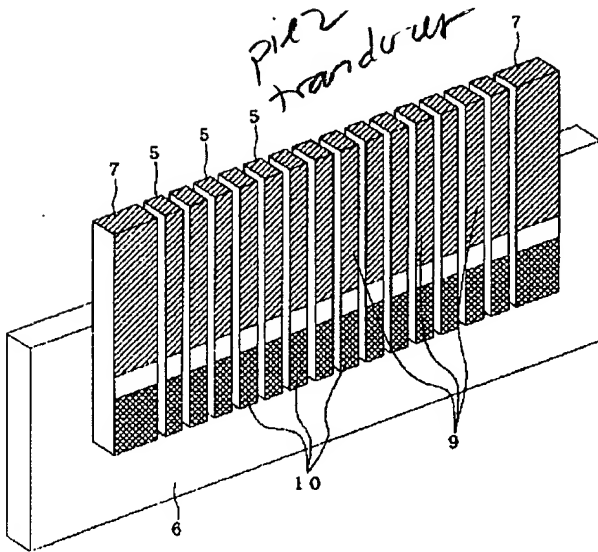
[Drawing 1]



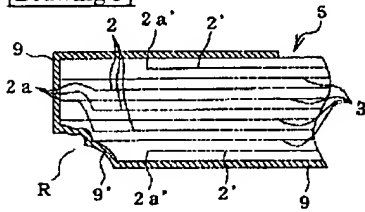
elastic plate / stainless plate



[Drawing 2]

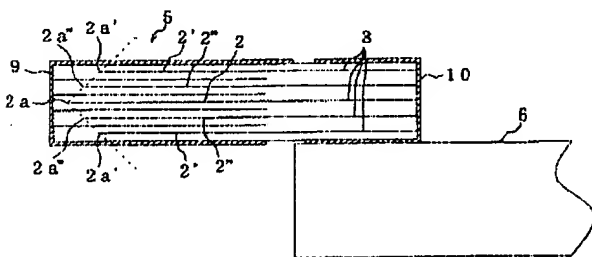


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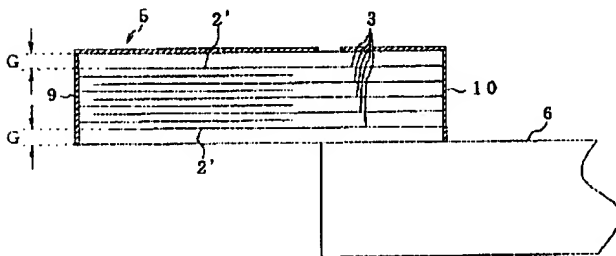


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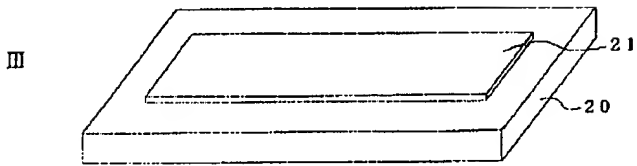
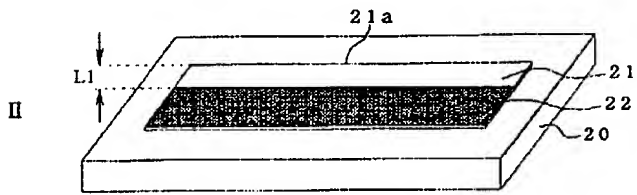
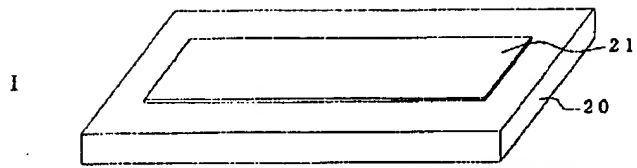
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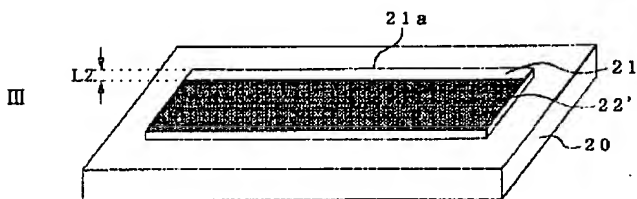
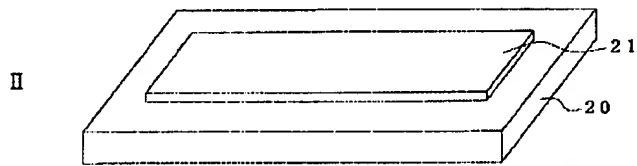
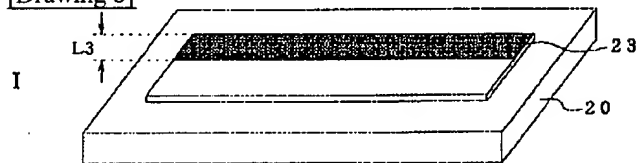
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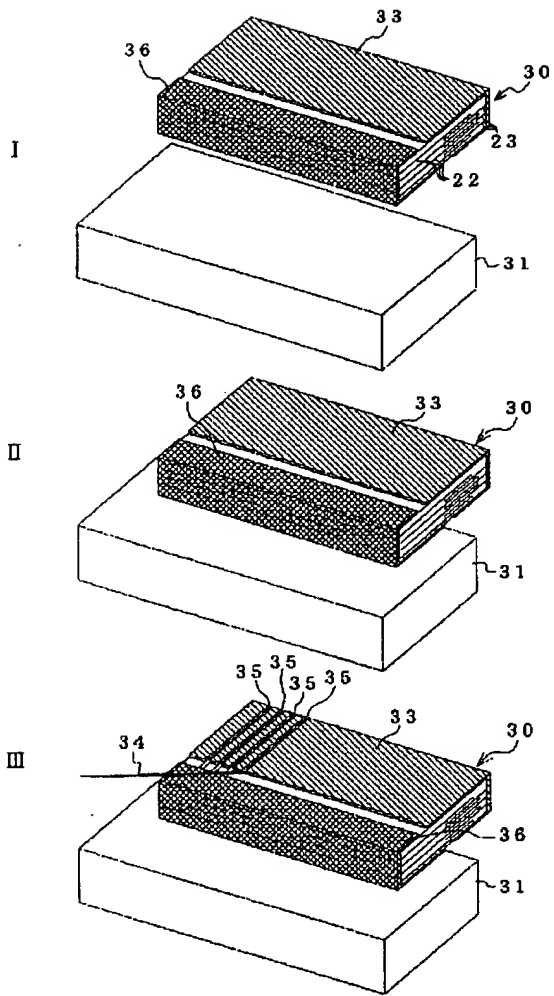
[Drawing 5]



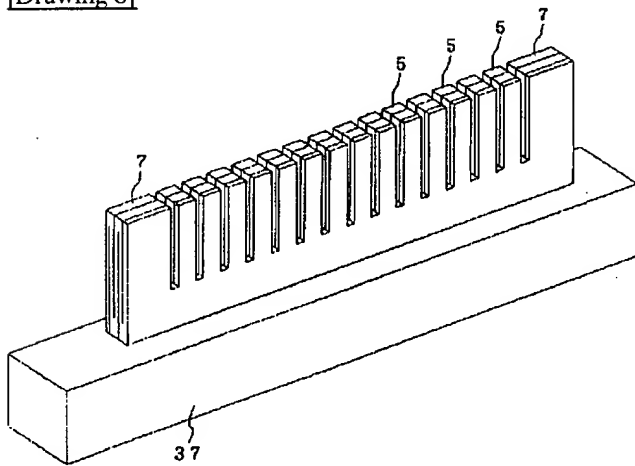
[Drawing 6]



[Drawing 7]

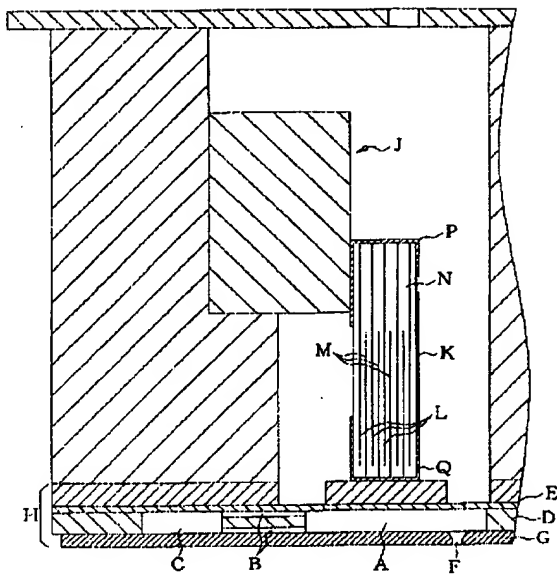


[Drawing 8]

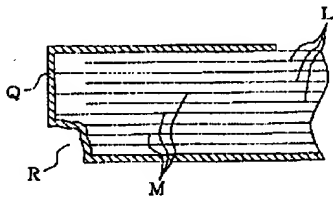


[Drawing 9]

(f)



(g)



[Translation done.]